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Construction and Validation of Textbook Analysis Grids for Ecology and Environmental Education

Silvia Caravita (silvia.caravita@istc.cnr.it), ISTC-CNR, Roma, Italia
Adriana Valente (a.valente@irpps.cnr.it), and Daniela Luzi (d.luzi@irpps.cnr.it), IRPPS-CNR, Roma, Italia
Paul Pace (paul.j.pace@um.edu.mt), University of Malta
Nicos Valanides (nichri@ucy.ac.cy), University of Cyprus , Cyprus
Iman Khalil (khalil@ul.edu.lb), Faculty of Pedagogy, Lebanese University, Lebanon
Guillemette Berthou (guillemette.berthou@montpellier.iufm.fr), IUFM, Montpellier, France
Adrienne Kozan-Naumescu (kozanadrienne@yahoo.com), Babes-Bolyai University Cluj, Romania
Pierre Clément (pclement@univ-lyon1.fr), LIRDHIST, Université Lyon1, France

ABSTRACT: Knowledge about ecology and environmental education (EE) constitutes a basic tool for promoting a sustainable future, and was a target area of the BIOHEAD-Citizen Project. School textbooks were considered as representative sources of evidence in terms of ecology and environmental education (EE), and were used for comparison among the countries participating in BIOHEAD – Citizen Project. The main goal of the analysis was to highlight the implicit and explicit values conveyed both by images and text in the respective textbooks from each country. This paper presents the theoretical background that guided the process of designing and development of several grids that were then used for analyzing samples of textbooks from 19 different countries. The paper also provides brief information indicating how EE is contextualized within each participating country's curriculum.

KEY WORDS: Environmental education, textbook analysis, values.

Introduction

Compliance of an increasing number of citizens to responsible consumer behaviour as users, customers, and voters, cannot be only the result of legislation, of shared actions of governments, or the introduction of constraints and environmentally oriented strategies of economic production. It should be a cultural revolution greatly influenced by the coordinated efforts of education and media communication. We believe that research can contribute towards this objective by providing insights relating to the factors and processes that underlie changes in people's beliefs. It is necessary to understand the reasons that motivate citizens to consciously align their attitudes and behaviours towards sustainable environment, and

to specify the conditions that can foster these attitudes and behaviours by paying attention from the beginning of the enculturation process.

The 'founding' of environmental education is attributed to Sir Patrick Geddes (1854–1933), who made for the first time the explicit link between the quality of the environment and the quality of education. Geddes pioneered instructional methods that brought learners into direct contact with their environment (Sterling, 1992). A definition of environmental education was formulated and adopted, first in 1970, by the International Union for the Conservation of Nature and Natural Resources:

> *Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture and, his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behaviour about issues concerning environmental quality. (IUCN, 1970).*

Initially, researchers have been engaged in attempting to describe the motivation that induces pro-environmental behaviour, and many studies have investigated the attitudes of people of all ages concerning different aspects of the relationship between humans and the environment. Many scales of indicators have been designed to probe environmental concern, and to highlight correlations among them and between attitudes and behaviours (Shepard & Speelman, 1985/86; Musser & Malkus, 1994; Cottrel & Graefe, 1997). Actually one of the most puzzling outcomes common to many of these studies is that this kind of correlation is rather low. As Sruffi (2001) stated in his survey of the studies that have taken into account this aspect of environmental education:

> *to feel oneself an environmentalist is not necessary to engage in actions for preventing or for repairing the damages caused to the environment; it seems enough to have and share some worries* (p. 101).

Psychology, sociology, the social construction of scientific knowledge, and the communication of science made up the theoretical frame of reference for understanding people's systems of beliefs and values. The socio-constructivist approach towards teaching and learning, and the processes of individual conceptual change suggest that the person should be viewed as a socialized agent, a historically and culturally determined individual.

Authors sharing the socio-cultural perspective have underlined that learning science involves learning to think, talk, and act as a member of the science community. It also involves developing the values and beliefs shared in the science community (Lemke, 1990; Roth & Désautels, 1995). Zimmerman (1996) stressed the relationships between knowledge, on the one hand, and feelings, attitudes, and values, on the other. He clearly wondered that:

> *... although it has been shown that intervention programs can increase knowledge and attitudes, how does existing attitudes relate to knowledge acquisition? Does the pattern of males displaying more knowledge and females displaying more positive affect and concern influence this performance? It is likely /.../ that the relationship between knowledge and affect is a complex one (p. 43).*

Ecology and Environmental Education (EE) are highly value-laden fields and should contribute to the construction of mutually consistent attitudes and behaviours (Sauvé, 1991, 1994; Giolitto & Clary, 1994; Rieunier, 2004). However, how this takes place and which are the sources and factors that make the messages that the students receive in educational settings more effective have not yet been deeply explored and understood.

Textbooks represent one of the pillars of formal education and they often represent the actual curriculum, since they may heavily influence the content, the approach, and the teaching style. In many cases, textbooks determine both the selection and sequencing of topics to be taught, and contribute to the kind of mental representations that students construct (Zahorik, 1991; Caritey, 1992; Mariet, 1982). Even more importantly, textbooks convey values either explicitly or implicitly, and incorporate a lot of obvious or hidden messages (Jacob, 1988). In most cases, teachers are not adequately prepared to correctly decode these messages or they do not pay enough attention to them, and, in these cases, they cannot promote a reflective and critical reading among their students.

Recent studies concerning textbook analyses have mainly dealt with the evaluation of content in relationship to scientific disciplines and to educational goals (correctness, completeness, comprehensibility, etc.) (Orlando, 2004; Snyder & Broadway, 2004; Stern & Roseman, 2004). Nevertheless, few studies were identified that have specifically addressed themes and topics relating to EE and the cultivation of values by EE (Jones, 1998; Ronneau & Kozan, 2005; Wade & Everett, 1994; Zachariou & Valanides, 2006).

The European Project "Biology, Health, and Environmental Education for better Citizenship" (BIOHEAD – Citizen) targeted the appraisal of subject matter for Ecology and EE, and aimed at raising future citizens' awareness of the problems and challenges that environmental sustainability imposes on our societies.

An initial attempt of the BIOHEAD-Citizen project focused on the development of several grids for the analysis of textbooks. This process was guided by the following questions:

- How do textbooks contribute to the construction of knowledge and the formation of beliefs and values necessary for the learner to correctly conceptualize and address the consequences that economic, political, and social choices have on the environment?
- Are textbooks promoting the development of thinking and attitudes that are necessary to cope with the complexity, the uncertainty, and the unpredictability of problems and solutions relating to environmental issues?
- Are textbooks supporting a multiple-perspective approach by presenting examples and real case studies?
- Which kind of human-environment relationships is encouraged by the images contained in the textbooks?
- Are the existing educational approaches compatible with the status of EE in the curricula?

The project focused on basic concepts and beliefs that can represent the complexity of the environment in more intelligible or more critical ways, so that they will become more interesting, attractive, and challenging for students at all educational levels. The cultural variety of the countries that participated in the BIO-HEAD-Citizen Project and the enriched context that a comparative analysis can provide seem to be a favourable opportunity for offering insights. Schultz and Zelezny (1999), who also took a cross-cultural perspective, reported the findings of studies that outlined key differences between Latino and Anglo views of the environment. Reliance on technical solutions or communal solutions, and humans as protectors or consumers of nature, and humans-in-nature emerged as distinctive characteristics of culturally-shared beliefs.

EE in the Curricula and in School Programmes

With its focus on sustainable development, Environmental Education (EE) has increasingly become a matter of concern in school teaching and curricula during the last decades. At the beginning, EE tended to be identified with ecology, and with the transmission of moral norms relating to respect and conservation of nature. Progressively, EE put more emphasis on the different aspects that characterize ways of living and using the environment, either at the individual or at the societal level. International declarations and agreements (Rio Declaration on Environment and Development, 1992) stressed the responsibilities of governments and societies for educating the new generations, and their citizens to adopt ways of living and behaving that support a more sustainable balance in the human-environment relationship.

Several cross-disciplinary studies (Funtowicz & Ravetz, 1999; Guespin-Michel & Ripoli, 2000; Cheiko & Clément, 2002; Caravita, 2005) dealing with complex systems have developed new theoretical perspectives and concepts, and displayed approaches for the interpretation of environmental processes of change. Coping with them might imply taking up the challenges from the uncertainty and approximation of knowledge, but also the significant contribution that the local expertise of people may provide. To which extent has school-knowledge been influenced by the advanced insights promoted by these studies?

Teachers' competencies are therefore seriously challenged. EE cannot be identified with a specific disciplinary field having a consolidated scientific tradition that provides references for the selection of content to be taken into account in the scheduling of teaching units, and for the definition of the competencies that students should achieve. Many materials and resources useful for pro-environmental activities have been made available to schools, but the didactical mediation of teachers is not always adequate to fruitfully enable the students to go beyond the behavioural level and attain the level of conceptual understanding. Teachers do not have easy access to scientific knowledge dealing with environmental issues, in formats that help them to design powerful and attractive learning environments for intellectual elaboration. Internet sources provide bits of information rather than knowledge organized in coherent frameworks and supported by accepted theoretical positions. EE requires a systemic approach for the interpretation of the

environmental issues and depends on collaboration among teachers of different subject matters for the integration, and not just the juxtaposition, of content that is separately treated without specifying the existing connections.

Another obstacle comes from the fact that teachers are not very inclined to tackle open problems with their students, or to deal with open-ended approaches and controversial information. Teachers often experience the uneasiness that originates from the conflict that exists between the values endorsed by EE and promoted in school, and those that are implicitly accepted and not discussed by parents and everyday culture. Under such circumstances, EE risks remaining a marginal area in school, an ideological domain aimed at encouraging pro-environmental attitudes and habits, and, therefore, mainly conceived as assertive transmission of behavioural norms. More demanding expectations from EE, such as, preparing persons who are intellectually and ethically equipped for the challenges of sustainability, or individuals actively involved in environmental action as members of their society and as global citizens, are thus largely not addressed.

Representatives of the countries participating in the BIOHEAD – Citizen Project initially shared information about the situation of EE in the curricula of their respective countries. EE is intensively highlighted in the educational policies of many countries as a direct consequence of the recommendation of UN and UNESCO, who declared the period 2005/2014 as the decade of "Education for Sustainable Development." In Algeria, for instance, four universities are engaged in the elaboration of instructional materials and in the organization of summer courses for teachers to support the introduction of EE in the Algerian schools during the 2006–2007 academic year. In France, a ministerial circular (July 2004) demanded from all the teachers of all subjects and at all levels to introduce "EE for Sustainable Development" in their courses. As a consequence, the biology programmes changed for the classes of lower grades starting from the sixth grade in 2005.

EE is mandatory in the national curricula of all the countries participating in the project. It is considered as a separate subject (compulsory or optional), only in some countries (Cyprus and Romania), and only for specific age groups (ages 14–15 or 11–16, or 16–19). In other countries, EE is included in the teaching of different subjects at the elementary and lower secondary school levels, mainly through natural sciences, but also in transversal areas, such as, civic education, social studies, and home economics. In France, Italy, Malta, and Portugal, environmental studies are specifically defined and recommended by the National Department of Education as topics to be treated by teachers. In some countries (e.g., Hungary and Italy), the national syllabi are not prescriptive and do not propose concrete concepts or ideas to be taught. They only describe general guidelines, because the schools have the autonomy to choose specific objectives and contents, and to decide their curricular planning.

Themes and issues of environmental concern are often the core of short-term programmes that are developed in collaboration with external educational agencies, or with support from local authorities, who include in their agenda the enactment of the goals defined by Agenda 21. The exchanges among students that take

place in school networks (e.g., "Reseau Ecole et Nature" and Comenius projects) are often grounded on environmental projects. EE tends to focus on life and earth sciences, geography, and technology at the upper school levels. EE is not always an obligatory course in the pre-service education of teachers. Thus, it is an obligatory subject for elementary school teachers in 12 of the participating countries and an optional subject in 2 other countries. It is also a compulsory subject in the education of secondary school teachers only in 9 countries, and an optional subject in 2 other countries, while, in some cases, it is dealt with as a transversal subject.

Agreeing on the Theoretical Constructs

The group of partners, who came from different cultural and educational communities, needed to share a common theoretical understanding, and accepted terminology concerning the constructs of values, beliefs, worldviews, and attitudes targeted by the present investigation. For the design of the grids to be applied for textbook analysis, these concepts had also to be linked to the educational objectives pursued by EE in view of sustainability and education for citizenship. Epistemological beliefs were also considered particularly relevant, because they affect the way knowledge is conceived, and its processes of construction and communication. As Alexander and Dochy (1995) stated:

> *Despite the documented power of knowledge and beliefs in theory and practice, specific understandings of these concepts remain elusive. For instance, despite the preponderance of references to knowing or believing in everyday interactions or professional communications, explicit definitions or explanations of these terms are rarely offered (p. 414)*

Beliefs are frequently defined in opposition to knowledge. Whilst ideas are the result of conscious thinking and follow a principle of logical coherence, beliefs are instead viewed as mental habits, a non-thematized cognitive use of tacit and unaware knowledge, very close to sensory and emotional experience. Their cognitive efficacy (predictive and explicative power, economy of thought) can only be evaluated ex post. Dewey (1910) offers a very keen description of beliefs and their origin:

> *(...) similar thoughts infiltrate our mind from obscure sources and through unknown routes, they become part of our mental equipment without our awareness. Tradition, imitation, instruction are responsible for them, and each one of these sources either relies on authority, either calls for some personal advantage of ours, either overlaps with some strong passion of ours (p. 134).*

Beliefs admit contradictions and they are very resistant to change. From the socio-cultural perspective, a person's beliefs are socially shared intuitions, though they have their roots in autobiographical experiences and values. The following sociological definitions of values seemed to fit to the aims of our project:

- systems of collective preferences that orient and justify the social actions of humans (Huron, 1994).
- element of a complex formed by beliefs, expectations/desires, options,

feelings, principles that are sources of identifications and of expression of a community of people (Eduthés, thesaurus de l'éducation)

- shared cultural standards according to which the relevance – moral, aesthetic, or cognitive – of the objects of attitudes, desires and needs can be compared and judged. "Value may be called an element of a shared symbolic system, which serves as a criterion or standard for selection among the alternatives of orientation that are intrinsically open in a situation" (Miceli & Castelfranchi, 1989, p.177).

Values are sometimes identified with beliefs, since they relate to what should be desired. Also, the boundaries between values and norms are not always clearly fixed. An individual's values are often related to relationships with authority or with "significant others," or are affectively loaded. On the other hand, one may not know how to justify one's own system of values and this might explain why values hardly change. Values, though, have been assigned a fundamental social function, that is, to ensure social stability and cohesiveness (Miceli & Castelfranchi,1989; Cameron, Brown, & Chapman, 1998).

All the attributes featuring beliefs and values, which we synthetically reported here, stress that any educational intervention should take care of the tension between knowledge and beliefs, both affected by values, both of rational and emotional nature, both oscillating between reflected and un-reflected intellectual processes, and between social and individual activity.

In the BIOHEAD project, we utilized the notion of *conception* (in French terminology) as defined by Clément (2006). Clément proposed a scheme, the **KVP** model, in which *conceptions* are the result of interactions among 3 components. K (= Scientific Knowledge), in the case of nature and the environment, emanates from various subject matter (Ecology, Geology, Physics, Chemistry, Economy, Sociology, Health, Law, etc.). V (= Value system), that is, Social representations that guide the choice, attitudes, and behaviour of individuals: beliefs, convictions, ideologies, philosophical standpoints, ethics, morals, etc., and P (= Referential Social Practices). In the case of EE, they refer to any practices related to nature and the environment, for pleasure or for jobs related to protection, or use of environmental resources.

> *Textbooks express but one of the many stages of didactic transposition. Each step can be analysed in terms of the interaction between scientific knowledge, systems of values, and the social practices of the actors implied in this step of the transposition* (Clément, 2006, p. 12).

We wish to point out two interesting elements of this scheme, that is, the emphasis on the interplay from which any *conception* is defined as emerging, and the recognition of the role played by social practices. Martinand (2000) insisted on the importance of social practices for the didactic transposition, but value systems are altogether important, as Clément and Hovart (2000) maintained, when analysing some situations of EE.

Confronting Systems of Values in EE

The targets of our analysis were the values and beliefs that influence topics, such as, nature (spiritualism, materialism), the relationship between humans and nature or environment (anthropo- or eco-centrism, socio-centrism, pragmatism, idealism), the ecological and environmental dynamics (reductionism, determinism, mechanicism, evolutionism), and the image of science and technology (scientism, legitimate pluralism of citizens' perspectives). Relevant general epistemological beliefs that contribute to the values passed on by the textbooks' exposition of their content are those concerning the nature of knowledge (i.e., as factual, proven information, or as interpretation of facts), the nature of learning (i.e., knowledge transmitted and acquired or constructed), and the perception of knowledge as either right or wrong (dualism), opposed to conception of the truthfulness of knowledge (dogmatism, relativism). Scientists too have "un-questioned" beliefs that may also originate from the disciplinary matrix in which they have been professionally encultured.

But, science has developed a critical approach to its own beliefs. One of the goals of science education may be to develop ambivalence. The ambivalent citizen, who appreciates all the attitudes and approaches to a certain issue, is the one whose decision may truly be taken "en connaissance de cause" (Dreyfus & Roth, 1991, p. 94). Education should conceive ethics as a reflexive process for becoming aware of the foundations of our agency, as development of an ethic competence, rather than as transmission of values.

During the BIOHEAD meetings, discussions took into account numerous typologies of values that have been elaborated by authors interested in highlighting the beliefs that underlie environmental attitudes and that should inform EE, an area which integrates many domains (Hungerford, Litherland, Payton, Ramsey, & Volk,,1988; Schwartz, 1994; Zimmeman, 1996; Goffin, 1998–1999; Jones, Merritt, & Palmer,1999; McKeown-Ice & Dendinger, 2000; Forissier & Clément, 2003; Forissier, 2003; Rieunier, 2004). Table 1, Table 2 and Table 3 show different ways of defining and contextualizing categories of values that have circulated among the partners. These offered guidelines for selecting the items of the grids.

The sense of a specific value (e.g., freedom, health) is a function of the ethical field in which it is embedded, because it is related to the system of values that features a particular ethic. Here are two examples:

- *The fundamental value of life:* The pro-life anti-abortion movement does not define life in the same way that an ecologist or the defenders of the Amazonic rainforest do.
- *The instrumental value of tolerance:* Greenpeace activists do not view tolerance in the same way as the organizations who try to promote democracy in a perspective of eco-citizenship.

Table 1

List of Values that Influence the Analysis and Decision Making in Environmental Issues

Moral values. Rights, Duties, Respect, Responsibility, Solidarity, Tolerance, Equality, Respect of human dignity, No discrimination, Justice. Gender equality. Preservation of ecosystems, Collective responsibility, Life, Equality among all living beings.
Political values. Democracy, Freedom, Constitutional state, Citizenship.
Aesthetical values Harmony, Beauty, Pleasantness. Beauty of nature and landscapes.
Economical values. Standard of living, Employment, Economy of resources, Development, Diminishing costs Sustainability, Planetary balance, Natural resources
Social values Education, Health, Property, Quality of life, Prevention of exclusion. North-South solidarity, Harmonization of the web of relationships between people-social groups- environment.
Ecological values Ecosystemic equilibrium, Richness of species, Richness of specific populations. Biodiversity, nature, respect of other forms of life, viability. Equality among all living beings.
Spiritual values Unity of beings, Transcendence.
Religious values Objects of cult, Rituals.
Scientific values Reliability, Critical attitude, Scientific innovation, Scientific development.
Egocentric values Personal satisfaction, Wellbeing, Minimal effort, Health, Freedom.

Table 2
Categories of Values Pertaining to Different Dimensions of Human Practical and Intellectual Activity that Are Relevant to Environmental Education

1. Ecological: Referring to the maintenance of natural systems that require biodiversity; to the perceived quality of the environment (local and global); to the feeling of "inter-being" with the other living beings; to the acceptance of constraints for human action, population growth, etc.; to the awareness and acceptance of the planet as a limited pool of resources.
2. Aesthetic: Referring to an appreciation of beauty and harmony through our senses; to the pleasure gained by this perception; to the value assigned to beauty relative to other environmental affordances.
3. Economic: Referring to the exchange of goods and services among people and countries; to the definition of the value of resources (natural resources, labour, knowledge, technology); to the ownership of resources; to equity in the accessibility of goods; to the creation and distribution of profit; to the criteria for calculating the costs and benefits of human plans of actions.
4. Cultural: Referring to the maintenance of the attitudes and the practices of social and cultural units (traditions, habits, knowledge); to the free circulation of information; to the accepted/promoted agencies of cultural changes; to the image of science.
5. Social: Referring to the maintenance of the cohesiveness of the social environment; to the management and ruling of individual freedom and of interactions within a society; to attitudes about diversities (gender, sex, age, culture); to the evaluation of quality.
6. Political: Referring to the ways of managing, ruling and controlling the interactions between individuals and society, humans and environment; the attainment and diffusion of human rights; the rights of minorities; the participation of citizens.
7. Ethical: Referring to taking responsibility as users of resources, as consumers of affordances (goods, services, information), as citizens who vote, as living beings empowered by conscience; to equity, justice, respect, tolerance as objectives of individual and society actions.
8. Existential: Referring to the ways of conceiving and managing one's own life and private sphere in relation to the environment where one lives; to the value assigned to the quality of life, to the person, to life itself (and to the other forms of life); to the role assigned to the spiritual dimension (religious, artistic, ideological) in one's own life; to the attitudes related to risk taking, to sacrifice enduring, with happiness seeking.

Table 3
Axes to Study Teachers' Conceptions Regarding Nature and Environment (Forissier & Clément (2003)

1. With Human Beings – Without Human Beings
Hypothesis: Conceptions relating to Nature are characterized by the absence of human traces, whereas, conceptions relating to the environment include anthropogenic actions.
2. Spiritualism – Materialism
The origin of the world and of life have been researched and presented in scientific theories that do not need divine or spiritual interpretations. The origins of environmental problems could also be researched. The hypothesis is that researching environmental problems could still be replaced nowadays with the idea of divine punishment due to the transgression of the "natural" order.
3. Systemic Approach – Simple causal determinism
Explaining an environmental problem can be reduced to one cause. The importance of such a parameter is oftentimes real and focusing on it can mobilize militants. However, every environmental problem is the result of a systemic functioning of intertwining factors. Focusing on one factor can be dangerously reductionist. On the other hand, stakeholders that have been identified as responsible for certain environmental problems would find it advantageous to hide behind a systemic approach that would mask their responsibility.
4. Anthropocentric – Ecocentric
The anthropocentric approach considers the environment in terms of resources and their benefit to humans; whereas, the ecocentric approach sees nature as finality in itself.
5. Interventionism – Passivity
Typical passive remarks would be: "Nature regulates itself"; "The best way to protect it is to do nothing". Regardless of the type of action one is undertaking (protection or exploitation i.e. ecocentric or anthropocentric), one can be active.
6. Local - Global
Environment could be considered under different scales (in space and time). This contrast measures the capacity of apprehending global environmental problems and taking them into consideration to the detriment of local and immediate problems.
7. Aesthetic aspects – Cultural aspects
This is not just an affective dimension. It is a cross-cutting dimension that can be found in any of the parameters hitherto: it is possible to assess. The aesthetic dimension is worthy of some attention. Often underestimated, it is related to cultural codes that are either profoundly anchored in history or related to fashion effects.

The Design of the Grids: The Operational Phase

Procedure

The design and construction of the grids to be used for the analysis of textbooks followed the same process in all the six areas selected by the BIOHEAD project (Health Education, Human Reproduction and Sexual Education, Human Origin and Evolution, Human Genetics, Human Brain, and, finally, Ecology and Environmental Education). It was the outcome of discussions in general meetings of the project partners and of the work of small sub-groups for each area, coordinated by one of the partners who was in charge of elaborating proposals.

The initially designed grids were test-piloted and then critically reappraised in a panel discussion with participants from the participating 19 countries. Based on insights and information from the discussion, the grids were modified and the refined semi-final version was tested by all partners on at least one textbook for each school level. Comments and remarks were used to reach acceptable agreement on the formulation of the items, considering the range of cultural differences. The decisions to be taken by the partners concerned the following issues:

- The inclusion in the analysis of aspects that were significant for the aims of the project and were transversal to all the areas (cross-grids).
- The selection of sub-topics within the main topics, in order to reduce the width of the analysis.
- The *conceptions* on which to focus:
  - the kind of qualitative/quantitative data to be gathered with the grids that could enable us to draw and compare results,
  - the type of books to be included in the sample to be analyzed, and
  - the procedure to be followed in the application of the grids.

The Selection of Sub-topics and *Conceptions*

The project team identified the following four sub-topics common to EEE to be checked in the textbooks from all countries:

- ecosystems and cycles (EC)
- biodiversity (BDY)
- pollution (PO)
- use of resources (UoR)

Environmental education is grounded on a sound comprehension of the concept of ecosystem as defined by modern ecology, particularly related with the dynamics of systems. The notion of biodiversity is also a central concept in the comprehension of evolution, and of the policies of ecological management and control, while its meaning is not restricted to inter- and intra-specific diversity, but also relates to ecosystems and cultures. Pollution and the use of resources are crucial topics that particularly involve values and beliefs, and that are central in an education for a sustainable future.

We would like to remind that equilibrium in nature, limits to development, and humans-nature relationship had been chosen as the three poles underlying

the New Environmental Paradigm (NEP) scale of indicators that was defined to measure people's environmental attitudes (Dunlap & Van Liere, 1978) and that has been applied in many investigations since then.

These conceptions have been selected as targets for our analysis:

- complex *vs.* linear systems,
- relationship of humans in respect to nature,
- global *vs.* local approach
- individual *vs.* social responsibility

For a convenient simplification, we characterized conceptions by illustrating the extreme poles of a continuum, which included a range of shades and grades that qualified concrete instances of conceptions. The way people integrate conceptions and use them are indications of their worldviews. These may be seen as the space resulting from situating oneself within the linear continuity of each conception and the bi-dimensional space of combined conceptions. Eco-systemic, Socio-systemic, Eco-socio-systemic views might be seen as the alternative worldviews that might be produced by diverse combinations of these conceptions. We synthetically illustrate the aspects that may characterize each conception and that have been used to identify the concepts to be used as indicators of the "presence" of the conceptions in the text and the images of the textbooks.

Complex vs. Linear View of Ecosystems and Cycles

- Webs vs. chains of ecological components
- High number and diversity of components of the ecological webs vs. stereotyped simplification of their components
- Functional vs. structural description. Functional perspective highlights factors, variables, constraints.
- Inter-dependence among the components vs. one-way relationships
- Presence vs. absence of feedbacks, retroactions, cycles.
- Dynamic view in terms of short- and long-term, reversible and irreversible processes vs. static (here and now) view
- Interpretation of events from systems as emergent from co-factors, from parallel processing vs. description/explanation of events deterministically caused

Humans as Internal vs. Humans as Spectators of Nature/Humans as Guests vs. Humans as Owners of Nature

- Humans as external sources of pressures, pollution destruction vs. humans as legitimate agents and users of resources
- Nature as the source of harmony and balance if not disturbed by human interference vs. human responsibility for environmental preservation
- Emphasis on risks, catastrophes, problems vs. balanced information about problems and about possible solutions
- Emphasis on ecological conditions of the "natural" environment vs. inte-

gration between ecological and social conditions

- Planet as a resource for humankind vs. planet as a resource shared with other living beings
- Planet as an unlimited resource vs. planet as a limited resource
- Focus on protection in the management of nature vs. limits and control in the use of natural resources
- Control and manipulation of diversity (biodiversity, cultural diversity) vs. appreciation of diversity as a resource
- Short-term vs. long-term evaluation of cost-benefits
- Human benefits vs. ecological benefits in the evaluation of the impact, costs, priorities
- Emphasis on the attainment of economic aims vs. social, cultural, ethical and aesthetic aims
- Unlimited trust in scientific and technological solutions vs. principle of precaution

Local vs. Global View of the Environment

- Specificity of environmental problems in local contexts vs. interconnection of environmental problems
- Focus only on local environments vs. multiple environmental typologies
- Specific description of towns/nations/natural environment vs. integrated presence (co-presence) of these environmental aspects
- Local legislation vs. compared legislation
- Locally focused view of resource management vs. globally oriented view of resource distribution and management
- Specific environmental behaviours (differing according to religion, geographical location, culture) vs. multiple behavioural typologies

Individual vs. Social Responsibility

- Emphasis on change in individual behaviours vs. emphasis on change in life styles at society level
- Adhesion to moral norms descending from sources of authority vs. community involvement
- Moral responsibility and "literacy" vs. political responsibility and literacy

The Construction of the EEE Specific Grids

Specific grids were elaborated for each sub-topic. Realistic evaluations that followed the pilot testing of the grids suggested a reduction in their number, so that not all the *conceptions* were taken into account for each one of the sub-topics. By keeping in mind the *conceptions*, lists of concepts were identified as pertinent *indicators*. The explicit presence/absence of these concepts in the text presenting the content was considered as evidence of underlying *conceptions* that implicitly influence knowledge construction and use. The application of the specific grids expects

the analyst to assess the occurrences of each indicator in the text by noting the page numbers and the eventual figure number of images. We reproduce here part of the EEE-specific grid for the sub-topic "Use of Resources," in order to facilitate readers' understanding of the described structure of the grids.

Table 3
Conception: Individual vs. Social Responsibility

Content (Themes, topics)	Indicators	Page number of Images	Figure number of Images	Occurrences in text
PREVENTION of WASTING the RESOURCES				
	Strategies for prevention			
	Focus on individual's behaviour change *(e.g, ..resource-saving behaviours, consumerism,...)*			
	Social policies valued as relevant factors for prevention *(e.g., citizen's associations, e nvironmentalist's programmes, anti-consumerism policies such as purchasing and advertising policies, recycling ...)*			
MANAGEMENT of RESOURCES				
	Strategies for sustainable food production			
	Focus on individual alimentary habits, on humanitarian support			
	Focus on changes in agro-alimentary policies			
	Strategies of sustainable use of resources			
	Focus on individual's behaviour change *(e.g.. resource-saving behaviours, consumerism,...)*			
	Focus on social policies valued as relevant factors for prevention *(e.g. citizen's associations, environmentalists' programmes, anti-consumerism policies such as purchasing and advertising policies, recycling ...technologies)*			
	Focus on economic policies			

The specific grids were integrated with the cross-grids that had to be adapted for the thematic area. Their items gathered information about, the table of contents of each book, the kind of images inserted in the specific thematic area, the proportion between text and images, educational style used, ethnic, historical, epistemological approaches, and affective dimensions. Conformity between the national syllabus and the textbooks' content was also checked. The application of

the cross-grids required gathering some quantitative data, such as, to report quotes from the texts and to present a categorization of images and the eventual scanning of images as useful documentation to be compared among partners. Table 4 exemplifies some of the data drawn from the application of cross-grids

Table 4
Data Drawn from the Application of Cross Grids to One Italian Textbook

	EC	PO	UoR	Bdy
Text				
N°pages of text	39	20,5	53	12
- more text than images	21.71	15	34	7
- more images than text	9,33	3	7	2
N° pages Exercises	8	2	10	
Images				
N° images	65	37	77	14
Type of images				
- photos	34	31	52	13
- empirical data	5	2	9	0
- conceptualizations	22	1	3	1
Types of environments				
- Natural environment without human activities				
Local environment	4	4	5	0
"Foreign" environment	4	2	3	1
- Natural environment with human activities	1	0	6	2
- Urban environment	0	7	4	0
- Rural landscape	0	1	15	2
Human impact				
- Negative human impact	0	8	15	4
- Management of environment	0	3	7	0
Presence of humans in images	0	2	11	1

The quantitative data that could be drawn from the application of the grids to the textbooks have been summarized in tables in order to enable the comparisons across sub-topics, textbooks, and countries. These data concern the number of pages and images dedicated in the examined book to each sub-topic, the evaluation of the amount of space occupied by text in relation to that occupied by images, the distribution of the images in the categories that had been pre-defined in terms of kind and content.

The procedure agreed upon for the application of the grids by all the partners was defined as follows:

- at least three textbooks for each educational level (primary, lower and higher secondary school) had to be analyzed.
- when possible, the textbook had to be selected from among those books that were mostly used in schools and from different publishers, (in some countries only one official textbook was available).
- the analysis should have been carried out by two researchers and followed by cross checking.

Each partner produced a national report from the results of the qualitative analysis. This information offered the ground for the selection of the most significant issues to be compared among the countries in relation to dominant cultural variables.

Conclusions

The grids developed by the project provided the instruments for collecting data that were required for the comparison among a wide variety of cultural contexts and facilitated the evaluation of the connections that exist between prevailing ideologies and knowledge transmission. The grids enabled the participants to gather well documented data to demonstrate the presence of beliefs and values in textbooks, and how they are not so consistent with the aims that societies declare and maintain in order to provide support for the education of their future citizens. Both, the comparative and the individual country results obtained through the BIOHEAD project can provide publishers and pre/in-service teacher education institutions with information, which can promote reflection on the implications that implicit values may have on the quality of the environmental education conveyed through textbooks.

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